REMARKS

Upon entry of this amendment, claims 1, 3-11, and 13-25 will be pending. Independent claims 1 and 9 are currently amended without introducing new matter. Support for the amendments may be found in the specification at, for example, page 3, second paragraph; page 5, second paragraph; and Fig. 4 (compressed video signal 402 input to look-ahead estimator 420).

Briefly, the present invention improves the art of video transcoding. Prior video transcoders operated by, first, partially or completely decoding an input video signal picture-by-picture, and second, differently re-encoding (transcoding) a decoded picture using only information in or derived from the currently decoded picture. Thus, in these transcoders, each re-encoded picture depends only on its own content. Instead, the present invention improves the re-encoding process by using information about characteristics of not-yet-decoded pictures along with information from the currently decoded picture. Use of future-picture information allows more effective choice of re-encoding parameters.[1]

Because many applications of the present invention are to MPEG-coded video signals, the attached Exhibit contains pages from a well known textbook providing a brief overview of MPEG signal coding. From this overview, it will be appreciated that MPEG exploits the inherent temporal redundancy of video by interframe coding of differences between video pictures. An MPEG encoder periodically selects an anchor picture and then transmits one, two, or a few neighboring pictures (dependent pictures) as differences from the anchor picture, the differences being coded as motion vectors and pixel differences.

The motion vectors code motions occurring in a scene between an anchor video picture and a neighboring video picture. The reverse process, applying the motion vectors to an anchor picture to form the neighboring, dependent picture, is known as predicting (or reconstructing)

1 The term "future" is used herein to mean not yet decoded or processed. Pictures are decoded and processed in transmit order, which can be different from temporal or display order.

the neighboring, dependent picture. Since picture prediction is not perfect, an MPEG encoder also transmits differences between the pixels of the actual image and of the predicted picture.

An MPEG encoder transmits an anchor picture before its neighboring, dependent pictures to simplify decoding.[2] Nevertheless, an encoder must store an anchor picture in a buffer long enough to decode subsequently received pictures dependent on the anchor picture. Decoding a current picture then involves, first, predicting the current picture from the transmitted motion vectors applied to the previously decoded and stored anchor picture, and then adding to the predicted picture the transmitted pixel differences. Thus, it can be understood that MPEG decodes a current picture by, first, predicting it from already decoded information, and second, correcting it using pixel differences.

THE REJECTION OF CLAIMS 1-6, 9-11, AND 13-19

The Office Action has rejected pending claims 1-6, 9-11, and 13-19 under 35 U.S.C. § 102(b) as anticipated by US patent no. 6,625,320 to Nilsson et al. ("Nilsson"). Applicants traverse this rejection because Nilsson does not identically disclose each and every element of independent claims 1 and 9.

Independent claim 1 recites in part:

> a look-ahead estimator to gather information from said input compressed video signal prior to input to said decoder and from said decoder to estimate current signal characteristics of a current picture and future signal characteristics of one or more future incoming pictures

(emphasis added). Independent claim 9 is similar. The Office Action contends that all these recited elements can be found in Nilsson as follows. First, it is contended that Nilsson discloses "a look-ahead estimator" at 31 of Fig. 3 which receives compressed video signal input at 32 of

2 This means that the transmit order of pictures in a video signal may differ from their display order. In display order, the neighboring, dependent pictures may either precede or follow the anchor picture. (Motion vectors from an anchor picture to a dependent picture that preceded the anchor picture in display order are called "backward" motion vectors; motion vectors from an anchor picture to a dependent picture that follows the anchor picture in display order are called "forward" motion vectors.) However, because the encoder transmits the anchor picture before its dependent, neighboring pictures, the display and transmit orders can differ.

Fig. 3 and decoder information input at 30 of Fig. 3. It is also contended, citing Nilsson at col. 2, lines 61-67, that this "look-ahead estimator" estimates signal characteristics of current and future pictures.

Since Nilsson is about MPEG transcoding (as is Kwok), it is important to correctly interpret the terms "future pictures" and "future signal characteristics" in the MPEG context. In this context, "future pictures" and "future signal characteristics" refer to pictures and signals which have not yet been input to an MPEG decoder or transcoder and/or taken up by the decoder or transcoder for processing, and the terms "current picture" and "current signal characteristics" refer to the current picture and current signals being actively and currently decoded by an MPEG decoder transcoder. In other words, the terms "past", "current", and "future" refer herein to the transmit and processing order of pictures, with "current" being what the decoder transcoder is currently working on. There terms do not refer to the pictures temporal or display order.

Further, it is important to understand that to decode (and, thus, to transcode) the current picture, it is first approximately predicted using information (an anchor picture and motion vectors) previously input to and decoded by the MPEG decoder, and then corrected with current pixel difference information. Thus, it can be appreciated that in MPEG "predicting" refers to approximately predicting the picture currently being decoded using previous, already-decoded information; it does not refer to predicting any characteristics of future pictures (or signals) that have not yet been input to an MPEG decoder (and/or taken up by the decoder for processing).

In view of this understanding, it is respectfully submitted that the in the Office Action contentions are incorrect, that Nilsson does not in fact disclose or teach these elements of independent claims 1 and 9 for the following reasons. First, unit 31 in Nilsson's Fig. 3 cannot be the recited "look-ahead estimator" because it is actually a "motion vector estimation unit". Nilsson at, e.g., col. 7, lines 14-18. As explained above, MPEG motion vectors and used to predict the current picture being actively decoded (or transcoded) from a past anchor picture that has been already input to the decoder and decoded. Motion vectors have no information whatsoever relating to future pictures (and/or future signals) that have not yet been input to, or taken up for processing by, the decoder (or transcoder).

Specifically, neither Nilsson's motion vector estimation unit 31 nor the select/compute vectors unit 32 estimates any signal characteristics for future pictures. Instead, both units cooperate to determine motion vectors only for the current picture being re-encoded with respect to an already processed anchor picture. See Nilsson at, e.g., col. 7, lines 18-41. Select/compute vectors unit 32 determines H.261-type forward motion vectors from MPEG-type forward and backward motion vectors.[3] See Nilsson at, e.g., col. 8, lines 8-14. Motion vector estimation unit 31 uses search to improve these vectors. These units do not estimate any characteristics whatsoever for future pictures. See Nilsson at, e.g., col. 9 line 66 to co. 10 line 21.

Further, Nilsson's "motion vector estimation unit" 31 is not structurally arranged to be a "look-ahead estimator" that "gather[s] information from said compressed video signal prior to input to said decoder". Reviewing Nilsson's Fig. 3 makes clear that the "compressed video signal prior to input to said decoder" appears in Fig. 3 only as the arrow to the left of demux unit 1 of the decoder, and is input only to unit 1 and is not input to "motion vector estimation unit" 31. The only inputs to Nilsson's motion vector estimation unit 31 are from "frame store" unit 14, from "one-frame delay" unit 35, and from "select/compute vectors" unit 32. But one-frame delay unit 35 is part of the MPEG decoder; frame store unit 14 is part of the H.261 encoder; and select/compute vectors unit 32 translates decoded MPEG motion vectors into H.261 motion vectors. See Nilsson at, e.g., col. 6, lines 60-67; and col. 7, lines 14-17 and 37-41. Neither of these units can provide a "compressed video signal prior to input to said decoder" to "look-ahead estimator" 31. See Nilsson at, e.g., col. 7, lines 34-41. Thus, Nilsson's "motion vector estimation unit" 31 cannot be the recited "look ahead estimator".

Moreover, unit 31 of Fig. 3 is merely a standard motion vector estimation unit which performs a standard motion-vector search in a small area (± 1 pixel) and is an integral part of a standard encoder. See Nilsson at, e.g., col. 7, lines 14-17; and col. 9, line 66 to col. 10, line 24. In contrast, the claimed "look-ahead estimator" is a unit separate and distinct from the separately-

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3 Note that forward or backward motion vectors relate an anchor picture to a dependent picture that either followed or preceded the anchor in display order. In this application and its claims, "past", "current", and "future" refer to the transmit order of pictures, in which an anchor precedes its dependent, neighboring pictures.

recited "decoder" and "encoder". See the specification at, e.g., Fig. 4 (look-ahead estimator 420, decoder 410, and encoder 430 are all separate and distinct units). Thus, Nilsson's motion vector estimation unit cannot correspond to the recited "look-ahead estimator" for this additional reason.

Finally, although Nilsson indeed uses the term "predictive", one of skill in the art would understand that this term does not refer to predicting future pictures that have not yet been input to a decoder or transcoder (or taken up for processing). Nilsson uses this term only in an MPEG context, where it refers to approximately "predicting" the current picture being currently and actively processed from already received and processed information. See Nilsson at, e.g., col. 1, lines 23-56. However, the claimed "future pictures" refers to pictures that have not yet been input to a decoder (or taken up for processing). Thus, the recited "future pictures" cannot be "predicted" according to the MPEG-limited teaching of Nilsson.

In conclusion, Applicants respectfully submit that Nilsson does not disclose these elements and limitations recited in both independent claims because Nilsson: (i) does not disclose any use of the "compressed video signal prior to input to said decoder"; (ii) does not disclose estimating characteristics of future pictures (that is, a picture, a picture group, or a picture sub-group not yet decoded); and (iii) does not disclose a "look-ahead estimator" unit separate from the decoder and the encoder.

Therefore, Nilsson does not anticipate either the independent claims nor their dependent claims, which inherit the patentable limitations of their parent independent claims. Withdrawal of the present rejections is respectfully requested.

THE REJECTION OF CLAIMS 7-8 AND 20-25

The Office Action has also rejected pending claims 7-8 and 20-25 under 35 U.S.C. § 103(a) as unpatentable over Nilsson in view of US patent no.: 5,889,561 to Kwok et al. ("Kwok"). This rejection is traversed because Kwok, like Nilsson, and thus the combination of both references, does not disclose or teach all the claimed elements, as is required for a *prima facie* case of obviousness. Withdrawal of this rejection is also respectfully requested.

Kwok discloses a method and apparatus for re-scaling an MPEG-encoded, compressed video signals from a higher to a lower bit rate in order to facilitate specific video applications. See, Kwok at, e.g., abstract. Kwok's re-scaling either simply deletes higher frequency DCT (discrete cosine transform) coefficients, or more coarsely re-quantizes the DCT coefficients. Importantly, this re-scaling and re-quantizing is performed block-by-block within the current picture only after the input signal for the current picture has been at least partially decoded (or decompressed). See, Kwok at, e.g., col. 2, lines 10-16. In all embodiments, a coded video signal input to Kwok's apparatus must be at least partially decoded (by a variable length decode (VLD) parse unit) within the decoder prior to re-scaling and re-quantizing. See Kwok at, e.g., 20 in Fig. 2; and 38 in Fig. 4.

Thus, Kwok, like Nilsson, does not disclose or teach gathering "information from said compressed video signal prior to input to said decoder". And Kwok does not, and cannot, disclose or teach the claimed "look-ahead estimator", which is a unit separate and distinct from the "decoder" and "encoder" that separately receives the incoming encoded (or compressed) video signal prior to its input to the decoder. Kwok merely adds an analyzer (and optionally a rate controller) within a pre-existing encoder in order to control the encoder's pre-existing quantizer to more coarsely quantize the output signal. See Kwok at, e.g., col. 5, lines 25-29; 22 in Fig. 2; and 40 and 47 in Fig. 4.

Because of the above, Kwok does not, and cannot, estimate a "picture complexity", or in fact any characteristics whatsoever, for future pictures. Instead, this reference processes a signal picture-by-picture, more coarsely quantizing each current picture macroblock-by-macroblock using only data in the current picture (and optionally on an externally pre-determined target output bit rate). This processing is not affected by signal characteristics of any pictures not yet decoded. See Kwok at, e.g., col. 2, lines 10-19.

Finally, Kwok does not disclose or teach estimating a "picture complexity", even for a current picture. In the embodiment of Fig. 4, relied on by the Examiner for such a teaching, analyzer 40 applies picture-by-picture a control parameter determined from the current picture to rate controller 47, and rate controller 47 then applies macroblock-by-macroblock within the

current picture a control parameter to quantizer 42. Kwok at, e.g., col. 5, lines 35-42. The output of these units is thus a quantizer control signal; the output is not a picture complexity, even for the current picture.

In view of the foregoing, Applicants respectfully submit that all the Examiner's objections and rejections have been addressed and that all of the claims in the present application are allowable. Accordingly, Applicants respectfully request that the claims be reconsidered and passed to allowance.

Consideration and allowance of application is respectfully requested.

Respectfully submitted,

10-25-04
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